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INSTITUTION OF CIVIL ENGINEERS.

THE PRINCIPLES AND PRACTICE OF ACCOUNTANCY IN RELATION TO ENGINEERING DESIGN AND WORK.

FRAME THOMSON LECTURE: 1912.

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THE INSTITUTION OF CIVIL ENGINEERS.

THE SECOND

FRAME THOMSON LECTURE:

FRIDAY, 26TH APRIL, 1912.

THE PRINCIPLES AND PRACTICE OF ACCOUNTANCY IN RELATION TO ENGINEERING DESIGN AND WORK.

JOHN STRAIN, Esq., Vice-Pres. Inst. C.E.,
IN THE CHAIR.

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Notice.

In the ordinary course the reports of these lectures are sent only to the students of the Institution. Some students who are approaching the limit of age for studentship have expressed the wish to receive the reports of future lectures. I shall be happy to meet their wishes by keeping a mailing list of those who desire to follow up the subject in this way if they will send me their names and addresses.

T. FRAME THOMSON,
CAEN WOOD TOWERS,
HIGHGATE,
LONDON, N.

THE INSTITUTION OF CIVIL ENGINEERS.

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THE PRINCIPLES AND PRACTICE OF ACCOUNTANCY IN RELATION TO ENGINEERING DESIGN AND WORK.

JOHN STRAIN, ESQ., Vice-Pres. Inst.C.E., IN THE CHAIR.

Supported by

SIR WILLIAM PLENDER, President of the Institute of Chartered Accountants.

L. W. HAWKINS, ESQ., Member of the Institute of Chartered Accountants.

HARRY CHEVALIER, ESQ., Member of the Institute of Chartered Accountants.

W. RUTHERFORD, ESQ., Managing Director, Dick Kerr & Co., Ltd.

F. H. WILKINS, ESQ., European Manager of the Western Electric Company.

BASIL MOTT, ESQ., M.Inst.C.E.

DR. TUDSBERY, M.Inst.C.E., Secretary of the Institution.

The Chairman :—

In introducing the lecturer, said it was with peculiar pleasure that he had accepted the President's invitation to preside over the meeting that evening. The lecturer was no stranger to the Institution, nor to him. Mr. Frame Thomson had been his pupil in Glasgow and his partner in Westminster, and although that connection had ceased many years ago it had left him a friend of whom he had always been proud, and whose career he had followed with the liveliest satisfaction. The students of the Institution were to be congratulated on having in Mr. Frame Thomson a friend who had not only founded the Lectureship, but had found time to deliver

the first two lectures of the Foundation. The first lecture, dealing with commercial and technical relations of engineering design and work, showed that the lecturer was not merely content to point the road to success, but, by examples from his own life's work, showed how he had achieved it. Such a lecture could not fail to bring out the characteristics of the lecturer, enterprising, painstaking, and, above all, thorough; and with that *perfervidum ingenium Scotorum* which has brought success to so many of his countrymen throughout the world, and he (the Chairman) was sure that in the lecture to which they were about to listen, those characteristics would be as much in evidence as ever. The Chairman then called upon Mr. Frame Thomson to deliver the second lecture of his foundation on " The principles and practice of Accountancy in relation to Engineering design and work."

Mr. Frame Thomson :—

My first duty this year is the painful one of recalling the sad death of Sir James Inglis, Past Pres. Inst.C.E., who, himself an old student, took the greatest interest in, and contributed many and useful suggestions towards, the foundation of this series of lectures. Those who were present at the inaugural lecture in 1911 will remember the genial and friendly remarks in which he encouraged the students to increase the efficiency of their technical acquirements by some familiarity with the commercial practice and principles of those with whom their profession brings them into contact. A pathetic interest has been given to that occasion by the fact that it was the last time Sir James took the chair at a meeting in the Institution. His loss leaves a blank in the circle of those to whom the students of the Institution could look with confidence for support and guidance, a blank which it will be hard for any of his successors to fill with equal devotion and personal interest.

In the opening lecture last year it was pointed out that the object of the series is to direct the attention of the students to the various features of commercial knowledge which will be found useful by them in the practice of their profession. It is obviously impossible that annual lectures should treat of the minute detail of each of the subjects to be touched upon. Such details, both of practice and principle, can be studied in all great centres of population by means of the classes provided by educational institutions of many kinds. Annual lectures can only be of real utility if their scope is confined to the treatment of the various subjects in a general outline calculated to inspire

interest that will lead to the desire to follow up the subjects by making use of the classes and literature devoted to their fuller exposition. There will be no attempt this evening to enter into a complete system of book-keeping, or to follow out all the principles of accountancy, but only to touch upon such salient features as will give a bird's-eye view of the subject as a whole. So far as possible the relationship between accountancy and engineering will be expressed in language familiar to engineers rather than in the strict terminology of accountants.

The subject naturally divides itself into two main sections, the Art of Book-keeping and the Science of Accountancy, which together comprise the practice of accounting.

The art of book-keeping provides the machinery by which the facts are recorded and correlated in terms of monetary units as the common denominator, so that the financial history of any enterprise may be clearly shown throughout its career and its financial position summarised at any time. A proper system of accounts must therefore:—

1. State correctly and with all essential detail the facts of each transaction.
2. Show the consecutive steps of analysis or synthesis by which the facts are grouped or sub-divided for the purpose of drawing conclusions from them, *i.e.*, ascertaining their effect upon the business as a whole or upon certain portions of it.
3. State clearly these conclusions or results.

In the early days of book-keeping the above objects were (and even to-day in very simple operations are still) accomplished by the easy method of putting down on one page with the needful particulars the amounts of money received, and on the opposite page similarly the amounts paid away, the difference being regarded as loss or gain, according to the side of the account which is in excess. But this primitive method was soon found to be lacking in any means of checking up the accuracy of the entries otherwise than by revising them in detail, and still more so as regards facilities for analysing the component elements. The engineering principle that action and reaction are equal and opposite was then appropriated by the accounting fraternity to their own use, and the modern system of double entry book-keeping evolved. Every simple monetary transaction involves two positives and two negatives in respect that a purchase for example leaves the purchaser richer and the seller poorer by the value of the article purchased, whilst on the other side the seller is richer and the purchaser poorer by the amount paid for the article.

The first stage in the application of this principle was the adoption of three books of account. The first, called the day book, consisted of a record in chronological order setting out the nature of each transaction, the parties interested, the sum involved, and the consideration passing in exchange for the money. The second stage, that of separating out the positives and negatives took place in the journal, a book with two columns headed credit and debit. Each item in the day book was transferred to the journal and there split into as many positive and negative entries as were required to show the effect of the transaction upon the parties to it, upon the stock of goods affected by it and upon the cash or other monetary equivalent involved in it. In the journal the entries succeeded each other in the same sequence as in the day book, the sequence disregarding any classification other than that of positive and negative. The final stage of allocating these positive and negative entries to separate accounts for the parties interested, the goods affected, and the cash or monetary equivalents was completed in the ledger, which comprised all the individual accounts necessary to show at any time the position of the business towards its owners, customers, stocks of goods, cash, etc. By taking out the balances of each account in the ledger at any given time and classifying them into one table with the positives on one side and the negatives on the other, the position of the business as a whole at that time is exhibited in what is known as the balance sheet.

As the complications of business increased, and with them the complexity of the factors influencing gain or loss, the labour required to handle a multitude of items through these stages, gradually assumed proportions which in extreme cases made the expense of the system prohibitive, and led to the development of systems varying in degree from the three books above described to the other extreme of ledgers in which, by means of parallel columns, the record of facts, and their analysis or synthesis, are all effected in one entry for each transaction, and the conclusions or results can at any time be made up on the same pages by suitable transfers and cross entries.

Whatever may be the system, the basic principle is that of stating each transaction, and each step in the analysis of the factors comprising it as an action and reaction, positive and negative, credit and debit, so that the arithmetical sum of all the columns corresponding to one of these opposites shall be equal to the sum of all the columns corresponding to the other. It is unnecessary in this lecture to enter upon the detail forms in which this principle is applied, as these can be studied in any text book on the subject, and if the basic principle is kept steadily

in view the functions of the several accounts composing any given system will not be difficult of comprehension.

More important for our present purpose than the machinery of the Art of Book-keeping are the principles of the Science of Accounting. It was pointed out last year that the evidences of life are growth and decay, and that in business these expressions are represented by profit and loss. There is no room in business more than in any other natural phenomenon for stagnation other than a temporary balancing of the forces tending to growth and decay. One or other of these forces inevitably predominates, and the function of accountancy is to provide the means of showing at any time which of them is in the ascendant and why, so that the forces tending to growth or profit may be encouraged and developed, and those tending to decay or loss reduced and eliminated.

The idea of growth involves the existence of something capable of growing, and in business matters this something is Capital. In order to construct a railway or a harbour or industrial works which shall carry on their several businesses the first essential is the money or Capital to build them. When built and commencing operations money has still to be spent upon operating expenses before the receipts begin to flow into the treasury, so that the second essential is working Capital in the form of cash and operating stores. Capital expenditure is thus in the first instance expenditure of all kinds necessary to bring the enterprise up to the point of productiveness. The money provided to meet this expenditure is the Capital of the concern, although as a general rule the word Capital is applied to the shares or other securities created for the purpose of being sold to produce that money.

When the point of productiveness is reached, and the enterprise begins operating a new phase is entered upon with the rendering of services or marketing of products in exchange for payment in money or money value. The receipts so obtained form the Gross Revenue of the concern. Out of this Gross Revenue the cost of labour, materials, salaries, and other current expenses internal to the business are paid, leaving, if successful, an excess of receipts over expenses, known as Gross or Trading Profit. From this are deducted non-current expenses such as depreciation, renewals, and expenses external to the business, such as taxes and interest on borrowed money, leaving the Net Profit. From the Net Profit appropriations are made to Reserve Funds of various kinds, including the redemption of any Capital invested in property of a wasting nature, dividends are paid to partners or shareholders, and the remainder is known

as the Carry Forward or Surplus. If the business expands so as to require new property or works or plant or working capital, fresh Capital may be introduced, or the additional expenditure may be provided out of reserves or surplus.

The above is an outline of the financial life history of every successful enterprise, and indicates the different processes composing it. The science of accountancy is directed to the study of the nature in detail of each of these processes, and of the principles upon which the dividing lines should be ascertained and the book-keeping records kept so as to present a true statement of the facts of each process, and the results of their operation.

We may now proceed to consider them in some detail under the following headings:—

1. Constructive or creative processes.
2. Productive or operative processes.
3. Destructive processes.
4. Reconstructive or reproductive processes.

As already pointed out, the Constructive or Creative processes are comprised under the headings Capital and Capital Expenditure.

In private partnerships the Capital usually consists of cash or its equivalent in property contributed by each of the partners to the joint fund by which the business is established. In joint stock companies the Capital consists of shares or securities intended to be sold to produce cash, or to be issued in lieu of cash in exchange for property, services, or rights. The holders of the shares are the partners in the business. The securities, other than shares, are usually some form of acknowledgment of indebtedness, and the holders of such securities are not partners but creditors of the company. But whether shares or securities the values so created for the purpose of providing the cash, property, services, or rights required to establish the business are its Capital. For accounting purposes the owners of the shares, as well as the holders of the securities, are regarded as creditors of the Company, that is to say the business is supposed to owe them the face value of the shares. It has to account for all the Capital by showing expenditure equal to it in amount. The Capital Expenditure is the positive or credit side of the Constructive process and represents the cash, property, services, or rights which " stand to the credit " of the Company, whilst the Capital is the negative or debit side, which the Company owes to the holders of its shares or securities. In so far as the Constructive processes are related to the Capital and Capital Expenditure the accountant has little to consider beyond suitable sub-divisions to show the actual amounts realised in cash or expended in the

acquisition of each class of property, services, or rights which the nature of the business requires to be shown separately. The question of sub-division has, however, an important bearing upon the proper appreciation of operating results, and is seldom, or never, carried out in sufficient detail at the outset of a Company's operations. In any business producing a variety of articles, or rendering a variety of services, the initial expenditure should be classified in the accounts so that as far as possible the results in the way of profit and loss on each variety can subsequently be considered with relation to the capital that has been expended specifically for its production, in order to guide the management in the matter of future development or restriction of the business in that particular variety. The other questions relative to Capital and Capital Expenditure arise principally under the headings of the Destructive and Reconstructive Processes, to be considered later.

The Productive or Operative Processes find their expression in Revenue and Expenditure on Revenue Account. Expenditure is incurred in the manufacture of products or the rendering of services, and is paid for out of the receipts from the sale of the products or services. In this case, as in that of Capital, the accountant's intelligence is chiefly exhibited in the proper marshalling of the facts so as to provide the management with the most useful comparisons of price and cost as a guide to the lines of development to be followed. The more intricate matters of principle arise in connection with the Destructive and Reconstructive Processes in their relation to Revenue.

We now come to consider the most debatable section of the subject, the treatment of the Destructive Processes.

At the birth of the enterprise we find that payments have to be made under the heading of preliminary expenses, for lawyer's fees, stamp duties, and other services, or liabilities in connection with the registration of a company and the creation of its shares and securities. To the extent that a company once created enjoys a position as an individual capable of carrying on business under the company laws, this expenditure produces something realisable by sale, but it is obvious that no purchaser would pay for the company's certificate an amount equal to that expended upon it, unless in exceptional cases where the name in itself had a market value that could not be duplicated by the formation of another company with a different name. At the very outset we are thus confronted with expenditure, the value of which if put to the test of a sale in open market would show a shrinkage or loss, which if action and reaction are to be equal and opposite must sooner or later be counteracted by some Reproductive Process.

At the next step, that of selling the shares or securities, we find that the services of brokers, financial houses, printers, probably advertising agents and others have to be paid for, and that the purchasers of the shares and securities will not pay for them the full face value but only buy them at a discount, so that here again we have shrinkages against which we must sooner or later set a Reproductive Process.

The acquisition of property and rights frequently involves heavy expenditure, as for example in obtaining an Act of Parliament, a Provisional Order, or a Concession from a foreign Government; or the property may include leases, patents, or other rights of a terminable character. The diminution in the value of these by lapse of time has to be reckoned with as a destructive force.

In the natural course of operating, the destructive effects of wear and tear become apparent, and may be classified under three main headings. The simplest class includes those in which no actual change takes place in the material components of the property or plant, but parts of them get out of adjustment and are restored to their original condition without any change of or addition to the structure. A simple example of such a case is the loosening of the fishbolts of a rail joint. Such cases properly fall under the heading of maintenance, and are as a rule included as part of the current operating expenses.

The intermediate class includes cases where a small accessory part of the main structure has to be replaced, as for example, a fishbolt with a worn thread or a broken fishplate. Strictly the expense in such cases should be divided between maintenance and renewals, the latter being charged with the cost of removing the old and supplying the new part, and maintenance with a portion of the cost of putting the new part in place. But in most instances this is a needless refinement, and the whole is charged to maintenance. Still it is useful to bear the distinction in mind, as instances may arise where the separation is necessary to maintain correct comparisons of expenditure in different periods.

The extreme class includes cases where the wear and tear may continue over a prolonged space of time before requiring to be dealt with, and then involving expenditure upon a scale such as would upset all periodical comparisons, if suitable provision for it were not made by anticipation. The wear of rails is a case in point. This class is dealt with under the heading of Renewal Fund amongst the Reconstructive Processes.

The Destructive Process known as Obsolescence is similar in kind to Depreciation (referred to later), and covers those shrinkages in value of such property as machinery, patent rights, etc.,

arising from the invention or discovery of improved machines or methods, with which the established machinery or methods are incapable of maintaining effective competition. Although similar in kind to Depreciation its effects must be counteracted by a Reproductive Process corresponding more closely to a Renewals Fund than a Depreciation Account.

An important Destructive Process is that of Depreciation. This applies to such kinds of shrinkage in value as cannot be made good by adjustment or renewal of component parts of the structure or property, but arise from a gradual decay or general falling off in efficiency of the whole combination of property rights and equipment, or of parts of it so important as to affect the whole.

It will be obvious that all the Destructive Processes outlined above have the effect of reducing the value or amount of the property, rights, or cash acquired by the issue of the Company's Capital, and that they cannot be counteracted by the creation and issue of more capital. The shrinkage in the value of the assets may be made good by the expenditure of money so raised, but this new action and reaction are equal and opposite in themselves, leaving no surplus to counteract the preceding destructive action. Consequently if the balance of forces is to be preserved, the Reproductive Processes must be derived from a portion of the profits arising out of the Productive Processes, or in accounting phraseology the loss of Capital must be made good out of Revenue.

In tracing the Destructive Processes the order followed was more or less the chronological order of their occurrence, but it will be convenient to follow the Reproductive Processes in the order in which they stand closer to or more remote from the daily operations of the enterprise.

Maintenance stands so close to these that many of the items of expense incurred under that heading cannot even be identified separately from the operations of producing the product or services. As a rule they can only be stated separately (as one of the operating expense accounts) when special individuals or gangs or equipment are devoted exclusively or largely to maintenance work. Where this can be done the intermediate class between maintenance and renewals (that in which small parts are replaced in addition to adjustments being made) is usually included under the heading of Maintenance. The Reproductive Process of Maintenance is thus absorbed into the expenditure side of the Productive Process.

As the relationship between receipts and expenditure in the Productive Process (revenue receipts and expenditure) has to be watched closely at short intervals of time, it is important that

the entries in its accounts should be confined to regularly current items, and items occurring at such regular periods and in such regular amounts that they can be ascertained and distributed over the comparative periods in correct proportions.

But all the Destructive Processes, with the exception of those provided for by Maintenance, are either liable to occur at irregular intervals or to operate gradually over long and perhaps indefinite periods of time, so the corresponding Reproductive Processes are dealt with by means of accounts separated from the Productive Process.

Next to Maintenance in proximity to operating expenses lies the provision to be made for Renewals. This is done by deducting from Net Revenue annually or semi-annually such a sum as will, if invested at a safe rate of interest, provide the amounts estimated to be required from year to year over a considerable period. These debits to Revenue are credited to Renewals Reserve Account, and when the amounts are definitely set aside in cash or investments, earmarked for this purpose, they become Renewals Reserve Fund. The distinction to be noted here is that an " Account " may be a record of transactions involving assets that are not quickly realisable, whereas the word " Fund " is now generally applied to an account whose balance is represented by cash or quickly realisable assets of a stable character. As the purpose for which Renewals Reserve is provided is one that demands prompt cash to meet its requirements, this distinction is a very important one to bear in mind when considering the soundness of an enterprise.

Next in order to Renewals Fund comes the Reproductive Process required to cover shrinkages definite in amount and in the length of time during which they occur. The rights conferred by an Act of Parliament or Provisional Order or Concession or patent or lease, in which a definite period is fixed for their termination fall into this category. The process adopted is to deduct from Net Revenue a suitable amount annually or otherwise, and credit the same to a Redemption Account. This may take the form of a Redemption or Sinking Fund represented by quick assets which, with accumulations of interest, will in the required period reach the amount of the shrinkage to be offset, or cash may be applied periodically to the repayment of portions of the Capital by the issue of which the rights have been acquired. But this process differs from Renewals in the respect that it is not essential to have the amounts set aside for it earmarked in cash or quick assets. If the other property of the concern is increased so that the Capital issued for the wasting rights becomes represented by assets of another kind the equality of action and reaction is preserved, and the

desired equilibrium between Capital and Property maintained. It sometimes happens that this equality is preserved by other processes than that of appropriating profits to meet it. For example, if a concern operating patent rights conducts its business on suitable lines, the protection afforded to it against competitors during the life of the patents frequently enables it to build up a goodwill or position in the market even more valuable than the protection afforded by the patents, so that the wasting of these is replaced by the growth of the goodwill. Many of the rights conferred by public authorities are capable of being turned to account in some such manner, so that on their termination their value has been replaced by other property.

Having now dealt with the reactions to be offset against those Destructive Processes which are more or less apparent on the surface of things, and definite in the time of their operation, we are left with the consideration of two vague but none the less real causes of wastage, Obsolescence and Depreciation. In both of these cases the daily facts of the business offer little by way of data upon which to found opinions as to their extent and duration. The provisions to be made for counteracting them must be largely guided by personal judgment. The only practical help that is obtainable is from a series of re-valuations from time to time of the entire property and assets of the concern. Such valuations, if made by really sound business men expert in the particular class of enterprise, will throw much light upon the extent and nature of the Reconstructive Process to be adopted.

Obsolescence may be counteracted by special additions to the Renewals Fund, or preferably by the creation of a Special Renewals Fund, but as a rule it is not dealt with separately from Renewals and Depreciation. If it is not to be dealt with separately it should be included with Renewals rather than with Depreciation, as the former provision must, if correctly handled, take the form of a Reserve Fund, having quick assets earmarked for it. Obsolescence creates the necessity for providing new equipment to replace old before the latter is worn out, so it is obvious that the means of purchasing the new equipment must be ready to hand when required, which is not the case if the shrinkage in value is merely offset by increasing the values of other fixed property, as may legitimately be done to counteract Depreciation.

The final Reconstructive Process is the Depreciation Reserve Account. This is usually created by debiting Revenue with amounts calculated upon assumptions as to the life of the whole or such parts of the property as may be liable to deterioration over a long period of time, and are not sufficiently definite in

character to be properly included in Renewals. The main object of the Depreciation Account is not the replacement of property or assets, but the maintaining of their value as a whole upon an equality with the amount of capital outstanding from time to time. Consequently it is dealt with in a variety of ways, falling into two main categories. The Depreciation provisions may take the form of a Sinking Fund, in which case cash is applied periodically in the purchase and cancellation of capital so that a reduction of the capital offsets the Destructive Process of Depreciation in the property, so preserving the equilibrium. Or, on the other hand, the balances of the Depreciation Account may be offset by additions to property, thus maintaining the latter in equality with the capital. Or, again, these methods may be combined, certain divisions of capital, such as redeemable debentures being periodically reduced by purchase, a similar amount being written off the value of property, and at the same time addition being made to property out of Revenue for the balance of the amount set aside for Depreciation.

In the above outline of the Reconstructive Processes, no mention has been made of preliminary expenses and discount on the issue of capital, which were referred to at the beginning of the description of Destructive Processes. The Reconstructive Processes counteracting such shrinkages are largely a matter of very divergent personal opinion. There seems to be no sound reason, other than excess of prudence, for dealing with them separately from Depreciation in general. The customary practice of writing off these particular items in a short period of years is based upon the fact that the capital issued against such expenditure is not represented by any specific asset realisable at that value. But if this principle were applied to all the property and assets similarly situated as regards deficiency in realisable value, no enterprise could legitimately declare profits until the Reconstructive Processes had made up the whole difference between the capital and the breaking up value of the concern. No one will dispute the prudence of any practice which, within reasonable limits, hastens the attainment of such a position, but it is nevertheless desirable to discriminate clearly between processes that are based upon sound principle and such as are merely desirable expedients. Preliminary and other expenses of a like nature, including those attending issues of capital, are just as clearly incurred for constructive or creative purposes as payments for land or the labour of laying bricks and mortar, and the Reconstructive Process of the Depreciation Account is properly applicable to them. This is specially clear in the case of discount on issues of capital redeemable by a Sinking Fund, as the redemption provided out of Revenue pays off

not only the actual cash received, but very often a premium as well, in addition to the Capital corresponding to the discount.

The lecture last year was of a very general character, and this year it has dealt with one of the broad subjects to which attention was drawn. Next year I hope to give a lecture on similar broad lines dealing with legal knowledge. Thereafter I hope the annual lectures will be delivered by an accountant or a lawyer, treating of some of the special features of their respective professions with which engineers should be familiar.

The Chairman

Proposed "That the best thanks of those present be accorded to Mr. Frame Thomson for the very able and valuable lecture with which he had favoured them that evening."

Mr. Arthur J. Hart: *(Chairman of the Commitee of the London Students)*—

In seconding the motion, said they all remembered, with Mr. Frame Thomson, the presence of Sir James Inglis in the chair last year and his kindly words, and they very deeply mourned his loss. The first lecture had aroused a great deal of interest among the students generally, and they were very delighted when they heard that Mr. Frame Thomson was to deliver the lecture again that evening. They had just heard that he was also going to deliver the third of the series, which would be looked forward to with more keenness than ever. He thought the tangible examples which Mr. Frame Thomson had given that evening of the various processes had made the lecture invaluable to students, and had enabled them to grasp its meaning in a very facile manner.

The vote of thanks was then put and carried with acclamation.

The Chairman

Said the meeting was favoured with the presence of two eminent accountants, and he had great pleasure in calling upon Mr. Hawkins and Sir William Plender to make some remarks.

Mr. Hawkins

Said he rose with considerable diffidence to address the meeting after Mr. Frame Thomson's lecture, especially in view of the fact that Sir William Plender, the distinguished head of his own profession, was present. The lecture was not only of interest to engineers, as setting forth very

clearly the principles of accountancy in relation to their own particular profession, but it was of interest and profit also to accountants, since it presented an intellectual survey of the subject from a point of view outside their own profession. The lecturer had expressed with much skill the principles guiding one profession in terms commonly adopted by another. In elucidating the principles of accountancy in terms of physics, the lecturer had, at any rate for him, thrown new light upon a subject in which he (the speaker) had been steeped for many years.

In dealing with the Capital Account the lecturer touched upon a subject which was a stumbling-block to many in the comprehension of a Balance Sheet. In the Balance Sheet of a firm or of a sole trader one found the Capital Account among the liabilities, and it was not a little puzzling that that should be the case, because one's natural impression was that if anything was an asset a man's own capital was. That was perfectly true, and Mr. Frame Thomson made it quite clear that the capital of a business was invested in the property, book debts and other belongings which made up the assets. The Capital Account did not represent the Capital itself, but was the measure of the amount of the Capital in the business. It was thrown on to the side of the account opposite to the assets themselves so that the two sides might agree, just as one threw a weight into a scale opposite the object to be weighed.

In the case of a Company, the position was not very different, since what corresponded to the Capital of a firm was, in the case of a Company, represented by the Capital of the Shareholders, and what was often known as Loan Capital was not the Capital of the Company at all, but indebtedness. The Shareholders' interest was measured by the amount of paid up Capital, plus the balances standing to the credit of Reserve and Profit and Loss Accounts, assuming the assets and external liabilities to be stated at their true value. Where the balance of Profit and Loss Account was a debit it had of course to be deducted from the Capital in order that the Shareholders' interest might be measured.

He was very glad to observe that the difference between a Reserve Account and a Reserve Fund was emphasised. It occurred all too frequently that Balance Sheets were disfigured by the words "Reserve Fund" on the debit or liability side. This was a contradiction of terms, because it was clear that a "Fund" meant money or investments, and could not possibly be in its right place among the liabilities. The item on the liabilities side would be correctly described as "Reserve" or

" Reserve Account," and was not the thing reserved or set aside, but merely the measure of it. It represented the extent to which profits made in the business had been set aside, *i.e.*, had neither been distributed as dividends nor carried forward in the general balance of Profit and Loss Account. The existence of the Reserve Account was justified by the fact that the net assets were correspondingly in excess of the capital. The profits represented by the Reserve might have been expended upon plant or other property, and in that case there was no " Reserve Fund." A Balance Sheet which contained on the liability side the words " Reserve Fund " and on the assets side nothing in the nature of a fund to correspond, was therefore doubly incorrect. Sometimes the profits which had been carried to Reserve were represented by a Reserve Fund of a similar amount, and in such a case the Balance Sheet should contain on the liabilities side the words " Reserve Account, invested as on the other side," and on the assets side Cash or Investments might correctly be described as " Reserve Fund."

Another important point which the lecturer made was the desirability of physically setting aside that portion of the profits which was allocated to Reserve for Renewals. If the profits carried to Renewals Account were invested in the business, it was quite obvious that when the time came for the Renewals to be effected there was no such thing as a Renewals Fund, on the simple principle that one could not eat one's cake and have it. If, on the other hand, the profits had been invested outside the business, the investments could be realised and the renewals could be effected without recourse to an issue of Shares or Debentures. He did not wish to imply that to use the Reserve in the business was indefensible, because it was often the fact that it could be far more remuneratively invested in that way than outside, but it was important for those responsible for the management of the Company to realise that if they followed that course their Renewals Account was not represented by a Renewals Fund, and that they would sooner or later have to rely upon the Company's power to issue securities.

Another of the points well made by the lecturer was the necessity of providing not only for the actual wear and tear and the wasting of assets, but also of writing off capital expenditure which did not represent tangible assets at all, *i.e.*, items of the character of preliminary and initial expenses. These were necessarily incurred in relation to the constitution and financing of a Company and the establishment of its business, but possessed no realisable value, and should, therefore, be cleared out of the

Balance Sheet as soon as practicable. That could only be done by applying a part of the profits in writing them off, and the process was one which it was desirable to begin early and continue liberally. The law permitted those items to appear on the credit side of the Balance Sheet, but they were not assets, and that was one of the reasons why most Balance Sheets were headed Dr. and Cr. rather than Liabilities and Assets. It was a good thing when a Company could get into the position of being able to describe everything on the right-hand side of its Balance Sheet as an asset. The process he was recommending had the effect of reducing the amount available for the division among the Shareholders, and that meant that the amount, which would otherwise have been distributed and therefore placed beyond the control of the Company, was retained within the Company itself. The writing off of capital expenditure, which was not represented by tangible assets, was no mere academic fancy, but was a means of strengthening the financial position, and, if carried on in conjunction with a system of liberal depreciation and renewals, and perhaps even a provision for new capital expenditure out of revenue, the result, while conducive to a paucity of dividends in the early part of the Company's history, could not fail to be of immense subsequent benefit to it. It was often the case that an ounce of strength from within was worth a pound of help from without. Or, to put it another way, profits used by a Company in its business might be regarded as muscle, while borrowed money might be no better than a crutch. It was by means of a conservative policy, such as he had indicated, that Companies were enabled to attain a position of unassailable strength, and the situation of a Company whose affairs had been conducted on those lines was likely to be altogether different from that of one whose management had concentrated its efforts on the payment of large dividends rather than the building up of reserves. It was not possible to state in general terms the point at which conservatism became, what Mr. Frame Thomson had described as "excess of prudence," but it was well to remember that excess of prudence could always be counteracted later by a freehanded policy, so that if it were a mistake at all it was one which could be undone.

In conclusion he would like to congratulate the audience, and at the same time to compliment the lecturer, upon the way in which the subject had been presented. The fact that the lecturer had viewed it from the comparative aloofness of another profession had perhaps enabled him the more clearly to deal

with general outlines and to see his subject whole and in true perspective. The lecture was certainly characterised by intellectual breadth of view, sound principles, and complete accuracy.

Sir William Plender

Said that it was possible if he had sought to express the lecturer's ideas as to accounting—which in the main were sound and incontrovertible—he might have adopted different phraseology or clothed his ideas in different forms. That, however, was a minor matter, and there were only two questions of principle which the lecturer had mentioned when dealing with accounts that he would refer to before alluding to what he thought was the essential and the fundamental principle of the lecture. The first was that it could not strictly be said that loss of capital must be made good out of revenue, as the Companies' Act provided machinery whereby lost capital might be written off by means of reduction in the subscribed capital after duly convened meetings of shareholders had been held sanctioning the process and it was afterwards confirmed by the Court.* The accumulation of cash or its investments representing a redemption or sinking fund could not easily be applied to the repayment of capital, if that expression meant share capital; but it might be used for the purpose of redeeming debentures of an undertaking if the constitution admitted. Before a reduction of share capital could take place, creditors' rights had to be considered, and the process of holding meetings of stock holders and an application to the Court had to be followed. Those, however, were somewhat trivial references to a most excellent paper, the substance of which, he thought, was that a very close relationship existed between the expenditure of money by the engineer and the knowledge of what was represented by that expenditure, which could only be provided in a good system of accounting. A true costing system meant an accurate knowledge of productive and operative outlays and, while that was a truism, yet the fact remained that in many undertakings true costs were unknown. It was generally possible to show what was the

* Note by the Lecturer: On page 11 the phrase referred to by Sir William Plender reads "*If the balance of forces is to be preserved* . . . . the loss of capital must be made good out of revenue" and in a successful business the revenue is sufficient to permit of this Reduction of Capital for the purpose of equalizing losses is the final resort when revenue is incapable of making them good within any reasonable time.

actual cost of labour and of material used on a particular piece of work, but that was only part of the cost. There had to be added a proportion of machine and shop charges and general administration expenses as well as interest on capital, so that the departmental manager who, for example, built his own locomotive or other form of rolling stock, would be able properly to measure his cost with that of an outside manufacturer. It was also seldom that records were kept which showed the maintenance and renewal charges of separate machines or groups of machines in large works, and their life of useful service. The consequence was that machinery very often had a great deal spent upon it to enable it to perform services which would be more cheaply carried out by a modern machine. Rather than face a loss on selling obsolete machinery, manufacturers were only too prone to continue spending money on renewals, which meant a heavier cost of production with less efficient results. The facts to enable them to form sound opinions as to whether it would not be cheaper to scrap old plant were too often unknown because a proper system of accounting had not been introduced. He had personally known cases where many thousands of pounds had been spent in patching up old machinery over a series of years, which, on enquiry and after investigation, had been found to amount to more than the cost of new and improved machinery; and when the fact had been brought to the knowledge of the proprietor he had, naturally, been astonished and resentful. Until the principle was recognised that the two sciences of engineering and accounting were closely connected there would be waste and ineffectiveness. Whilst it would be foolish for engineers to assume the functions of accountants or for accountants to usurp those of the engineer, yet a great step forward would be gained if engineers realised the value of true accounting principles and saw to their introduction. Proprietors of works sometimes looked upon money spent on bookkeeping as being unproductive, whereas the waste which resulted from its absence probably far exceeded its cost. It was highly important that a sound basis of arriving at depreciation should be instituted in large works, as true profit divisible amongst shareholders could not be known until the wear and tear, which took place in machinery used for production, was arrived at. It had lately been said by one of the Judges of the High Court that, in addition to all sums actually expended in repairing machinery or in renewing parts, there must be written off a proper sum for depreciation, and it was not profit until a sum, varying with the class of machinery, with the nature

of the business and the life of the machine, had been written off. Profit-sharing between employers and workpeople was a principle which was likely to be extended, and in this connection facts as to wear and tear would become increasingly important and necessary. He had had an instance not long ago where he was invited to institute an enquiry as to the relation which net profit bore to effective capital employed, and the facts were needed to assist a court of arbitration in considering whether the demands of the workpeople for increased wages might properly and fairly be met. In arriving at net profits it was essential to consider the life of plant and machinery in use, and provide for its proper maintenance, and for its extinction over the right term of years. He only mentioned this fact to show that in accountancy and in engineering, wear and tear or depreciation was a primary and most important matter.

He congratulated Mr. Thomson most heartily on his lecture. It was one of the best papers he (Sir William) had ever listened to which dealt, by a non-professional Accountant, with accounting questions. He heartily congratulated him on his thorough grasp of the subject, and on the very skilful and illuminating way in which he had treated it.

Mr. Frame Thomson

In reply, said it gave him the very greatest possible pleasure to feel that the students had taken an interest in the lectures, because he was certain that no one could listen to them with real pleasure unless they already knew something of the subject. He trusted, as the lectures went on from year to year, there would always be a certain number of students in touch with them, who would begin to appreciate the bearing of the different points, and also that they would become more and more useful and interesting. He desired to express his great pleasure at the fact that Mr. Strain had been kind enough to take the chair that evening. Last year Sir James Inglis, who undoubtedly was one of the prime movers in founding the lectures, or rather in giving the link which led to their establishment, presided; and that evening Mr. Strain, to whose training and guidance he (Mr. Thomson) certainly owed anything he had in the way of practical appreciation of business facts and methods, and an inclination of mind to follow them up, had taken Sir James' place.

He desired to thank Mr. Hawkins for the very great pains he must have taken in preparing his remarks. He thought also that all felt the greatest possible indebtedness to Sir William

Plender for attending the lecture. They knew he was not only a busy man, but quite an exceptionally busy man. He thought the remarks which had fallen from Sir William Plender and Mr. Hawkins had made a most delightful finish to that night's proceedings. The speeches had been thoroughly practical, sound, and to the point on accounting matters, and would give students a great deal of material for thought and study. He proposed a hearty vote of thanks to Sir William Plender and Mr. Hawkins for having been good enough to attend the lecture and support the movement, and with the resolution he coupled the other guests—gentlemen who represented large concerns. That was one thing he would like students to appreciate. Last year there were present a very powerful body of gentlemen of finance and others. The same could be said of the present occasion. He hoped students would be impressed by the fact that the necessity of engineers having some commercial knowledge was felt by the people who were going to pay engineers for doing work. Those were the men engineers had to consider. The article the engineer has to sell is his brains, and he had to have it ready in the form and with all the accessories which would enable it to command the best price, and which would enable it also to conform to the requirements of those gentlemen with money to invest, or works to carry out or direct.

The votes of thanks were carried by acclamation.

A hearty vote of thanks was accorded to Mr. John Strain for presiding.

In order to preserve the continuity of the series for those who were not present at the previous lecture, an abstract of it is provided in an appendix.

APPENDIX.

ABSTRACT OF PROCEEDINGS AT THE FIRST FRAME THOMSON LECTURE, 1911.

Sir James Inglis, who presided, announced that the lecture was the first of a series upon the necessity of keeping commercial principles in view when designs of engineering works are being made. He pointed out that the Institution had taken a leading part in promoting the theoretical and liberal training of young engineers, and that other practical training is now receiving attention. He summed up the commercial duties of the engineer in the words, "a reasonable return on money, safety in working and use, and permanence and stability."

Mr. Balfour Browne, K.C., leader of the Parliamentary Bar, expressed warm approval of the suggestion that engineers should have knowledge of commercial matters. He said: "You must, to a certain extent, be a bit of an accountant, and you must know something about law, the laws of evidence, of contracts, and other things of that sort. You cannot be specialists except in engineering, but at the same time a general knowledge will be of admirable service to you in your profession."

Mr. George A. Touche, M.P., Chartered Accountant, cordially approved the high standard set before engineers. He condemned the too prevalent feeling that the business side of engineering enterprises is unworthy of the engineer's attention. He summed up the commercial side of the engineer's work in the correct anticipation of the cost of construction and estimates of revenue in relation to working expenses. He said: "From the point of view of the City and finance we do not want everything to be dominated by the consideration of cheapness at any cost. The essential point to the commercial and financial mind is that the estimate of the engineer should not be misleading. Temper your optimism and enthusiasm by the analysis of detail and by attention to the thousand and one difficulties which lie in the way. Study to be reliable."

The lecturer introduced his subject by a reference to the change that has taken place in the attitude of the professional

classes towards commercial questions, the old prejudice against these as being sordid and inimical to high ideals, now rapidly disappearing. He traced the transition in the means of obtaining resources for the construction of engineering works from the earliest days when these were entirely supplied by autocratic governments, down to the present time when private capital is the chief source of supply, and demands a profitable return as a *sine quâ non* of providing the funds. This condition has brought with it the need that engineers should have some familiarity with the habits of thought and methods of business of those who control capital; with the principles of accounting which determine questions of profit or loss; and with the legal principles that govern commercial affairs. He laid great stress upon the value of well-regulated imaginative power as tending to maintain high ideals, and as a great help in suggesting solutions of engineering and business problems. He mentioned that his own knowledge of commercial law had been obtained at evening lectures, and his knowledge of accounting principles largely by keeping his personal accounts on the recognised double-entry lines. He recommended these methods to the students of the Institution.

The following extracts give the main points of the lecture.

" The object of these lectures would be hopelessly perverted if they tended to lower the ideals of which every engineer is proud. On the contrary, it is my earnest hope that one of the results will be to impress upon you that permanent commercial and financial success not only may, but must, be based on the same principles of reliability, efficiency and security that you apply in your technical work. To have a sufficient and intelligent understanding of the principles and practice underlying the operations of merchants and financiers, so that where our work is precedent, parallel or supplementary to theirs, we may adjust it to produce the greatest combined efficiency, is no discredit to an engineer. The very nature of an engineer's training and instincts provides him with many habits of thought and action which make him a valuable collaborator, provided he is possessed of the working knowledge to appreciate their application to other activities than his own purely technical branch."

" The profit of a harvest is the excess by which the value of the crop exceeds the cost of the seed and the expense of the operations. To secure a profit the organism must be capable of growth."

" Stagnation is a condition inconsistent with the life of a healthy organism. Growth and decay are the active manifesta-

tions of life. By the prevention of decay and the stimulation of growth maximum efficiency is obtained. Any enterprise that is radically sound cannot help growing (that is, making profits) if every element of waste and loss can be eliminated."

"These considerations may appear at first sight to be more properly within the functions of the operating engineer, but the designer and constructor, to be of the greatest value, must think backwards from the field of action of the operating engineer to the starting point of their own problems."

"Your contact with the human element does not end with the labourers, foremen, superintendents and managers. Behind all these are the brains whose financial ability secures the means by which your works come into existence. The functions of their formulæ are capital and profit; their great common denominator is money. What we have all to realise is that, just as much as steel and concrete, money is one of the things we have to deal with in engineering structures."

"And it is precisely in such relationships that the engineer finds the greatest value in general commercial knowledge. I am not for a moment advocating that you should be jacks of all trades and masters of none. But I do advocate that you should be *pastmasters in the art of taking pains*, and whilst your greatest pains should be devoted to the mastery of your own profession, a suitable proportion of your time and ability and labour should be devoted to making yourselves familiar with the methods of work and ways of thought of other professions and businesses."

"Don't get the idea into your heads that any smattering of law which time will permit of your obtaining will justify you in acting for yourself in matters which are the province of the lawyer. A little knowledge is a dangerous thing if it inspires presumptuous self-confidence. One of the great benefits of a little knowledge of law is that it opens out to your view many pitfalls of which you would otherwise be unconscious, and provides a danger signal warning you to secure sound legal advice when you might otherwise blunder into serious errors."

"Your position will be immensely strengthened if you can intelligently understand accounts, analyse them, and recast them into statements which go further than the accounts in showing the grouping of expenditure or receipts so as to throw important sidelights on special aspects of cost or revenue. Especially important is this faculty in relation to the operating accounts of commercial and industrial enterprises. In these matters there is no more effective solvent than the ability to represent the

course of expenditure and receipts graphically, and your familiarity with this method provides you with a valuable means of tracing out problems, based upon accounts."

" No amount of care or study will absolutely guarantee success for any enterprise, but care and study intelligently applied will at any rate reduce the adverse contingencies to the limits of ordinary business risks. They may even make all the difference between success and failure, as has been proved over and over again in cases where water-logged concerns have been pulled round and set on their feet by men capable of seeing the defects and applying the remedies. To correct such a situation, or to foresee and prevent it, obviously requires some knowledge of all the elements, and not merely complete knowledge of one of them."

" I should like to urge upon you the belief that there is no kind of knowledge that does not find its niche of utility at some time or other in your careers. In a very special degree this applies to making copious notes of all information, wherever you find it, of the cost of work and materials. It is not sufficient merely to note these data and index them, you must expand them and reduce them to units of general application. There is a subtle but very real analogy between the cost of work of different kinds and executed under different conditions, the appreciation of which is perhaps more of a natural talent than an acquired accomplishment, but is capable of great development by continuous assimilation of all available material respecting costs of all kinds."

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